

# SPACE 94: ROBOTICS FOR CHALLENGING ENVIRONMENTS

## Paper summary for Environmental Investigation and Remediation

### A Mobile Robot for Remote Response to Incidents Involving Hazardous Materials

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#### ABSTRACT

First entry into a situation where hazardous materials have been **accidentally** released or spilled is extremely dangerous. Often the type of material, its exact location, and extent of the **spill** is unknown. Mobile robots provide a means to safely explore an incident site to locate the **spill** and aid in material identification as well as mitigation. The use of robotics in incidents involving hazardous materials can significantly reduce the risk of human injury.

This paper will report on the status of the Emergency Response Robotics project, a **teleoperated** mobile robot system being developed at the Jet Propulsion Laboratory for use by the JPL Fire Department/**HAZMAT** Team. The project, which began in 1991, has been focused on developing a robotic vehicle which can be quickly deployed by **HAZMAT** Team personnel for first entry into an incident site. The primary goals of the system are to gain access to the site, locate and identify the hazard, and aid in its mitigation. The involvement of JPL Fire Department/**HAZMAT** Team personnel has been critical in guiding the design and evaluation of the system.

The current robot, called HAZBOT III, is based on a REMOTEC ANDROS V vehicle which has been significantly redesigned. A tracked base with articulated front and rear sections allow the vehicle to climb stairs and other obstacles, as well as maneuver in tight surroundings. A six-degree of freedom manipulator enables HAZBOT 111 to perform a variety of manipulation tasks including unlocking and opening doors which may be encountered at an incident site. Two video cameras provide feedback to the system operator: one cameras is located on the gripper and the second is located on a movable pan/tilt platform which can be positioned to best meet the task at hand. A commercially available specific gas sensor has been incorporated in the manipulator to aid in hazardous material identification. A unique feature of HAZBOT 111 is its special design for operation in combustible environments, This includes the use of all solid state electronics, brushless motors, and internal pressurization.

Demonstration and testing of the system with HAZMAT Team personnel has show that teleoperated robots, such as HAZBOT III, can successfully gain access to incident sites locating and identifying hazardous material spills. Work is continuing to enable more complex missions through the addition of appropriate sensor technology and enhancement of the operator interface.